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papillæ. The capillaries are connected together at the bases of the secondary papillæ, and arise from a common trunk immersed in the body of the papilla. The nerves are found to subdivide in the separate cones, in which they ascend to the apex and terminate in abrupt extremities, as in the frog, toad, &c. In the fœtus the fungiform papillæ are stated to consist of a simple cone without any secondary papillæ.

3. The conical or filiform papillæ of man are described to be of a compound nature, consisting of numerous secondary cones springing from a common stem. Each of these secondary cones is clothed with an elongated process which is fitted on the cone like a sheath. This process consists of elongated epithelial scales ascending towards the summit, and resembling in general appearance the feather of an arrow. At their summit these processes are clothed with an external zone of granular matter, which considerably adds to their thickness. This granular matter is often detached after the papilla has been removed a short time from the tongue. The blood-vessels form a simple loop at the summit of the papilla, and the nerves are arranged in a similar manner.

4. The inferior surface is described as very smooth, presenting numerous follicles abundantly supplied with blood-vessels and nerves. These follicles are generally of a conical shape and surrounded with an arch composed of epithelial cells. The nerves may frequently be detected and followed over the surface of the follicle, but their extremities are hidden amidst the blood-vessels.

The author has illustrated the paper by several drawings.

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March 8, 1849.

The MARQUIS OF NORTHAMPTON, V.P., in the Chair.

A paper was read, entitled "Additional Observations on the Osteology of the *Iguanodon* and *Hylæosaurus*." By Gideon Algernon Mantell, Esq., LL.D., F.R.S., V.P.G.S., &c.

This memoir is supplementary to the author's former communications to the Royal Society on the same subject, and comprises an account of some important additions which he has lately made to our previous knowledge of the osteological structure of the colossal reptiles of the Wealden of the South-east of England.

The acquisition of some gigantic and well-preserved vertebræ and bones of the extremities from the Isle of Wight, and of other instructive specimens from Sussex and Surrey, induced the author to resume his examination of the detached parts of the skeletons of the Wealden reptiles in the British Museum, and in several private collections; and he states as the most important result of his investigations, the determination of the structure of the vertebral column, pectoral arch, and anterior extremities of the *Iguanodon*. In the laborious and difficult task of examining and comparing the numerous

detached, and for the most part mutilated bones of the spinal column, Dr. Mantell expresses his deep obligation to Dr. G. A. Melville, whose elaborate and accurate anatomical description of the vertebræ is appended to the memoir. The most interesting fossil remains are described in detail in the following order.

*Lower Jaw.*—Since the author's communication on the lower jaw of the Iguanodon, published in the Philosophical Transactions, part ii. 1848, he has discovered the right *angular* bone, which was previously unknown: from the circumstances under which this relic was found, he considers it probable that it belonged to the same individual as the teeth figured in Plate XVIII. of the Philosophical Transactions for 1848.

*Vertebral column.*—The vertebræ hitherto assigned to the Iguanodon consist of the middle and posterior dorsal and anterior caudal, as identified by means of the Maidstone specimen in the British Museum: the cervical, anterior dorsal, lumbar, and posterior and terminal caudals, were previously either undetermined or referred to other genera of saurians. The investigations of Dr. Melville have established the important and highly interesting fact, that the cervical and anterior dorsal vertebræ of the Iguanodon were convexo-concave—that is, convex in front and concave behind—as in the fossil reptile of Honfleur termed *Streptospondylus*, and in the existing pachyderms; the convexity gradually diminishing, and the anterior face of the body of the vertebra becoming flat, in the middle and posterior part of the dorsal region. The supposed Streptospondylan vertebræ of the Wealden (named *S. major* by Professor Owen in British Association Reports on fossil reptiles) are, in the opinion of the author and Dr. Melville, the true cervical vertebræ of the Iguanodon. The convexo-concave type of vertebræ was not confined to a single genus—the *Streptospondylus* of the Oolite—but prevailed in two, and probably in several, genera of extinct saurians of the secondary geological epochs; in like manner as the reverse form, the concavo-convex, predominates in the existing crocodilians and lizards.

Other large vertebræ found with ribs and bones of the extremities of the Iguanodon, and referred by Professor Owen to one or more species of Cetiosaurus, are regarded, in consequence of the peculiar structure of the neural arch, as belonging to the posterior dorsal and lumbar vertebræ of the former colossal reptile; and certain somewhat angular vertebræ, also previously assigned to a species of Cetiosaurus, are presumed to be the middle and distal caudals of the Iguanodon.

*The Sacrum*, of which portions of several examples belonging to individuals of much disparity in size have been obtained, is shown to consist of *six* ankylosed vertebræ; not of *five*, as described by Professor Owen; and the typical specimen in the possession of Mr. Saull, which the author figures and describes, is adduced in proof of the correctness of this opinion. The anterior vertebra, and the two posterior ones, are much larger and stronger than the three intermediate elements which occupy the centre of the arch of the sacrum.

*Pectoral arch.*—A perfect scapula discovered in the strata of Tilgate Forest, and which corresponds with the coracoid bone, provisionally assigned to the Iguanodon in the memoir of 1841 (Phil. Trans. Pl. IX. fig. 11), Dr. Mantell has been enabled to refer to that reptile, by the fortunate interpretation of portions of two scapulæ which are preserved in the Maidstone specimen, but had not previously been recognized as such. As the clavicles were long since determined, the essential elements of the pectoral arch are now ascertained, and the author gives a restored outline of this important part of the skeleton, based upon these data.

*Humerus.*—A humerus three feet long, discovered by Mr. Fowles-tone in the Isle of Wight, has been ascertained by the author to belong to the Iguanodon, from the presence of a small but corresponding bone in the Maidstone fossil. This bone, from its disproportionate size in comparison with the femur with which it is collocated—being one-third shorter—was formerly assigned by Dr. Mantell to the forearm; but the large humerus from the Isle of Wight, which, except in magnitude, is identical with that from Maidstone, leaves no doubt upon the subject. It is now therefore, for the first time, ascertained, that in the Iguanodon, as in many fossil and recent reptiles, the anterior extremities were much shorter and less bulky than the posterior. The radius and ulna are still undetermined, but the author states that there are some imperfect bones in his former collection, now in the British Museum, which he thinks will be found to belong to the fore-arm.

*Hinder extremities.*—The colossal magnitude of the Iguanodon is strikingly shown by some femora and leg-bones recently discovered. One *femur* is 27 inches in circumference, and must have been 4 feet 8 or 10 inches in length; and a tibia, found with the same, is 4 feet long.

*Dermal scutes and spines.*—The author figures and describes several dermal scutes and spines, and states that a microscopical examination of the large angular bones of the Hylæosaurus (Phil. Trans. 1841, Pl. X. fig. 1), supposed by him to be ossified dermal spines, but which Professor Owen regarded as the abdominal extremities of ribs, proves the correctness of his own opinion; their structure being identical with that of the acknowledged dermal scutes.

In the summary which concludes the memoir, Dr. Mantell states that the facts described confirm in every important point the physiological inferences relating to the structure and habits of the Iguanodon and Hylæosaurus, enunciated in his former communications; and thus, after the lapse of a quarter of a century, he concludes his attempts to restore the skeletons of the colossal saurian herbivores, of whose former existence a few water-worn teeth and fragments of bones were the only indications, when, in 1825, he first had the honour to submit to the Royal Society a notice on the teeth of the Iguanodon.

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